Bandgap engineering of ZnO (3.37 eV) change with different doped material and with the narrow or wide sheet material, offered future applications of ZnO:doped-based nanostructured materials in optoelectronics as low-cost, miniaturized, sensors, solar cells, light emitting and CMOS-compatible devices.

The purpose of the presented work is to show some effects related to In doping the ZnO nanocrystal (NC) films. In-doped Zinc Oxide (ZnO:In) thin films have been prepared on quartz substrates by ultrasonic spray pyrolysis technique (USSP). These films were further annealed in controlled nitrogen gas flow for improving crystallinity and stoichiometry. In order to understand the material properties of ZnO:In thin films, X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Raman Spectroscopy, Energy Dispersive X-ray Spectroscopy (EDS) and Photoluminescence (PL) methods have been used for the comparative study of ZnO and ZnO:In NC films. The varying of In contents in ZnO NCs was within the range of 0.5%, 1%, 1.5%, 2%, 2.5%, 3%. Raman and XRD studies have shown that thermal annealing stimulates the ZnO crystallization with the formation of wurtzite crystal lattice. XRD and EDS methods have been used for the confirmation of doping of the ZnO NCs by In. In crystalline ZnO and ZnO:In NCs PL bands appear with the PL peaks at 2.08, 2.50 and 3.18 eV. The reasons of emission transformation in different samples and the nature of optical transitions have been discussed.

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